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CLAIMS

1. A tissue viability monitor (TVM) for determining viability of a biological tissue comprising:

5 at least one light source controllable to illuminate the tissue with light that is absorbed by an analyte in the tissue to generate photoacoustic waves therein;

at least one acoustic transducer that generates signals responsive to the photoacoustic waves;

10 means for generating a temperature difference between temperature of the tissue and an ambient temperature of surrounding tissue; and

a controller adapted to control the means for generating a temperature difference in the tissue and to control the light source to illuminate the tissue with light absorbed by at least one analyte in the tissue and wherein the controller processes the signals generated by the at least one transducer to determine concentration of at least one analyte in the tissue and to determine
15 temperature in the tissue and therefrom a relaxation time during which the temperature difference relaxes to zero and uses the concentration and relaxation time to provide a measure of viability.

2. A TVM in accordance with claim 1 wherein the controller processes the signals to
20 determine locations of sources of the photoacoustic waves within the tissue.

3. A TVM in accordance with claim 2 wherein the locations of sources of photoacoustic waves are determined with a resolution equal to or better than about 100 micrometers.

25 4. A TVM in accordance with claim 2 wherein the locations of sources of photoacoustic waves are determined with a resolution equal to or better than about 50 micrometers.

5. A TVM in accordance with claim 2 wherein the locations of sources of photoacoustic waves are determined with a resolution equal to or better than about 20 micrometers.
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6. A TVM in accordance with any of the preceding claims wherein the at least one analyte is a plurality of analytes.

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7. A TVM in accordance with any of the preceding claims wherein the at least one analyte comprises the redox state cytochrome a₃.
8. A TVM in accordance with any of the preceding claims wherein the at least one analyte comprises Hydrogen ions.
9. A TVM in accordance with any of the preceding claims wherein the at least one analyte comprises hemoglobin.
10. A TVM in accordance with any of the preceding claims wherein the at least one analyte comprises oxygenated hemoglobin.
11. A TVM in accordance with any of the preceding claims wherein the means for generating a temperature difference comprises an acoustic transducer, which the controller controls to transmit acoustic waves to the tissue that generate the temperature difference.
12. A TVM in accordance with any of the preceding claims wherein the controller determines temperature of the tissue during generation of the temperature difference to monitor the generation of the temperature difference.
13. A TVM in accordance with claim 12 wherein the controller controls the means for generating a temperature difference responsive to the determined temperature.
14. A TVM in accordance with any of the preceding claims wherein to determine the relaxation time the light source illuminates the tissue with light at a wavelength at which light is absorbed by water to generate photoacoustic waves in the tissue and the controller uses the signals generated by the at least one transducer to determine temperature of water in the tissue and thereby of the tissue.
15. A TVM according to any of the preceding claims and comprising a catheter having a probe end that is positioned in a neighborhood of or in contact with the tissue to determine tissue viability and wherein the light source comprises an optic fiber having an optic end located at the probe end from which optic end light that illuminates the tissue is radiated.

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16. A TVM in accordance with claim 15 wherein the at least one acoustic transducer comprises at least one acoustic transducer mounted in the probe end of the catheter.

5 17. A tissue viability monitor (TVM) for determining viability of a biological tissue comprising:

at least one light source controllable to illuminate the tissue with light that is absorbed by an analyte in the tissue to generate photoacoustic waves therein;

10 at least one transmitting acoustic transducer controllable to transmit waves that are incident on the tissue;

at least one sensing acoustic transducer that generates signals responsive to the photoacoustic waves and waves from the incident waves that are reflected by the tissue;

means for generating a temperature difference between temperature of the tissue and an ambient temperature of surrounding tissue; and

15 a controller that processes the signals responsive to photoacoustic waves to determine concentration of at least one analyte in the tissue and the signals responsive to reflected waves to determine temperature of the tissue and therefrom a relaxation time during which the temperature difference relaxes to zero and wherein the controller uses the concentration and relaxation time to provide a measure of viability.

20 18. A TVM according to claim 17 wherein the characteristic is a frequency shift of the scattered acoustic waves relative to a fundamental acoustic frequency of the structure of the tissue.